AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Original) A method of classifying a cardiac response to a pacing pulse, comprising:

defining a plurality of classification windows relative to and subsequent to the pacing pulse;

sensing a cardiac signal following the pacing pulse;

detecting one or more characteristics of the cardiac signal within one or more particular classification windows of the plurality of classification windows; and

classifying the cardiac response to the pacing pulse based on the one or more detected characteristics and the one or more particular classification windows.

2. (Original) The method of claim 1, further comprising:

detecting noise on the cardiac signal; and

canceling the classification of the cardiac response based on the detection of noise.

3. (Original) The method of claim 1, wherein defining the plurality of classification windows comprises defining one or more classification windows associated with a captured response.

4. (Original) The method of claim 1, wherein defining the plurality of classification windows comprises defining one or more classification windows associated with a non-captured response.

5. (Original) The method of claim 1, wherein defining the plurality of classification windows comprises defining one or more classification windows associated with a fusion/pseudofusion response.

6. (Original) The method of claim 1, wherein defining the plurality of classification windows comprises defining a plurality of non-overlapping classification windows.

7. (Original) The method of claim 1, wherein defining the plurality of classification windows comprises adapting a timing of a particular classification window.

8. (Original) The method of claim 1, wherein defining the plurality of classification windows comprises adapting a duration of a particular classification window.

9. (Original) The method of claim 1, wherein defining the plurality of classification windows comprises:

defining a first classification window based on a timing of a cardiac signal feature associated with a captured response; and

defining one or more additional classification windows in relation to the first classification window.

10. (Currently amended) The method of claim 9, wherein defining the first classification window based on the timing of the feature associated with the captured response comprises defining the first classification window based on the timing of a captured response template peak.

11. (Original) The method of claim 9, wherein defining the first classification window based on the timing of the feature associated with the captured response comprises defining the first classification window based on the timing of an evoked response template peak.

12. (Original) The method of claim 9, wherein defining the one or more additional classification windows comprises:

defining a second classification window to occur before the first classification window; and

defining a third classification window to occur after the first classification window.

13. (Original) The method of claim 1, wherein detecting the one or more characteristics of the cardiac signal comprises detecting one or more morphological features of the cardiac signal.

14. (Original) The method of claim 1, wherein detecting the one or more characteristics of the cardiac signal comprises detecting a peak of the cardiac signal.

15. (Original) The method of claim 1, wherein detecting the one or more characteristics of the cardiac signal comprises detecting a peak width of the cardiac signal.

16. (Original) The method of claim 1, wherein classifying the cardiac response comprises comparing the one or more characteristics to one or more references respectively associated with one or more types of cardiac responses.

17. (Original) The method of claim 16, wherein the one or more references are adaptable.

18. (Original) The method of claim 16, wherein a particular reference is adaptable based on a statistical variability of the particular reference.

19. (Original) The method of claim 1, wherein classifying the cardiac response comprises classifying the cardiac response as a captured response.

20. (Original) The method of claim 1, wherein classifying the cardiac response comprises classifying the cardiac response as a non-captured response.

21. (Original) The method of claim 1, wherein classifying the cardiac response comprises classifying the cardiac response as a non-captured response and an intrinsic beat.

22. (Original) The method of claim 1, wherein classifying the cardiac response comprises classifying the cardiac response as a near non-captured response.

23. (Original) The method of claim 1, wherein classifying the cardiac response comprises classifying the cardiac response as a fusion/pseudofusion beat.

24. (Original) The method of claim 1, wherein:

detecting the one or more characteristics of the cardiac signal comprises detecting an amplitude of the cardiac signal; and

classifying the cardiac response comprises:

comparing the detected amplitude to an amplitude reference; and

classifying the cardiac response based on the comparison.

25. (Original) The method of claim 1, wherein:

detecting the one or more characteristics of the cardiac signal comprises detecting a slope of the cardiac signal; and

classifying the cardiac response comprises:

comparing the detected slope to a slope reference; and

classifying the cardiac response based on the comparison.

26. (Original) The method of claim 1, wherein:

detecting the one or more characteristics of the cardiac signal comprises detecting a curvature of the cardiac signal; and

classifying the cardiac response comprises:

comparing the detected curvature to a curvature reference; and

classifying the cardiac response based on the comparison.

27. (Original) The method of claim 1, wherein:

detecting the one or more characteristics of the cardiac signal comprises detecting a peak width of the cardiac signal; and

classifying the cardiac response comprises:

comparing the detected peak width to a peak width reference; and

classifying the cardiac response based on the comparison.

28. (Original) The method of claim 1, wherein:

detecting the one or more characteristics of the cardiac signal comprises detecting one or more feature points of the cardiac signal; and

classifying the cardiac response comprises:

providing a template;

comparing the one or more feature points to the template; and

classifying the cardiac response based on the comparison.

29. (Original) The method of claim 28, wherein providing the template comprises providing a captured response template.

30. (Original) The method of claim 29, wherein providing the captured response template comprises updating the captured response template using one or more additional captured response beats.

31. (Original) The method of claim 29, wherein providing the captured response template comprises forming the captured response template using one or more captured response beats.

32. (Original) The method of claim 29, wherein forming the captured response template comprises:

delivering one or more pacing pulses at a energy level exceeding a capture threshold;

sensing one or more cardiac signals following the pacing pulses; and

forming the captured response template using the one or more cardiac signals.

33. (Original) The method of claim 32, wherein delivering the one or more pacing pulses at an energy level exceeding the capture threshold comprises delivering the one or more pacing pulses during a capture threshold test.

34. (Original) The method of claim 28, wherein providing the template comprises providing an intrinsic beat template.

35. (Original) The method of claim 34, wherein providing the intrinsic beat template comprises forming the intrinsic template using one or more cardiac beats representative of an intrinsic cardiac beat.

36. (Original) The method of claim 35, wherein forming the intrinsic beat template using one or more beats representative of an intrinsic cardiac beat comprises:

sensing rate channel signals of the one or more cardiac beats;

sensing shock channel signals of the one or more cardiac beats; and

forming the intrinsic template using the rate channel signals and the shock channel signals.

37. (Original) The method of claim 28, wherein providing the template comprises providing an evoked response template.

38. (Original) The method of claim 37, wherein providing the evoked response template comprises:

providing a captured response template;

canceling a pacing artifact from the captured response template; and

forming the evoked response template using the pacing artifact canceled captured response template.

39. (Original) A method of classifying cardiac pacing responses, comprising:

delivering a sequence of pacing stimulations to a heart;

defining a plurality of classification windows relative and subsequent to each pacing stimulation;

sensing cardiac signals following the pacing stimulations;

detecting characteristics of the cardiac signals within particular classification windows,

comparing the characteristics to one or more references respectively associated with types of cardiac pacing responses; and

classifying cardiac pacing responses based on the comparisons and the particular classification windows.

40. (Original) The method of claim 39, further comprising:

detecting noise on the cardiac signals; and

canceling classification of the cardiac pacing responses based on the detection of noise.

41. (Original) The method of claim 39, further comprising using the classifications of the cardiac pacing responses to determine a pacing energy capture threshold.

42. (Original) The method of claim 41, wherein;

delivering the sequence of pacing stimulations to a heart comprises delivering a sequence of pacing stimulations of variable energy; and

using the classifications to determine the pacing energy capture threshold comprises:

detecting loss of capture if a predetermined number of cardiac pacing responses are classified as non-captured responses; and

determining the pacing energy capture threshold based on the loss of capture detection.

43. (Original) The method of claim 42, wherein detecting loss of capture comprises detecting loss of capture if a predetermined number of cardiac responses are classified as non-captured responses.

44. (Original) The method of claim 43, wherein the predetermined number of cardiac responses is about two out of about three cardiac responses.

45. (Original) The method of claim 44, further comprising generating a captured response template using one or more cardiac signals associated with captured responses.

46. (Original) The method of claim 42, wherein delivering the sequence of pacing stimulations comprises delivering a sequence of pacing stimulations of decreasing energy.

47. (Original) The method of claim 42, wherein delivering the sequence of pacing stimulations comprises delivering a sequence of pacing stimulations of increasing energy.

48. (Original) The method of claim 39, wherein classifying the cardiac pacing responses comprises classifying a non-captured response.

49. (Original) The method of claim 39, wherein classifying the cardiac pacing responses comprises classifying a captured response.

50. (Original) The method of claim 39, wherein classifying the cardiac pacing responses comprises classifying a fusion/pseudofusion response.

51. (Original) The method of claim 39, wherein classifying the cardiac pacing responses comprises classifying a near non-captured response.

52. (Original) The method of claim 39, wherein classifying the cardiac pacing responses comprises classifying a non-captured response and an intrinsic beat.

53. (Original) The method of claim 39, wherein:

comparing the characteristics to the one or more references comprises comparing a peak amplitude of a particular cardiac signal to a peak amplitude reference; and

classifying the cardiac pacing responses comprises classifying a particular cardiac response as a non-captured response if the particular cardiac signal has a peak amplitude less than the peak amplitude reference.

54. (Original) The method of claim 39, wherein:

detecting the characteristics within the particular classification windows comprises detecting one or more characteristics of a particular cardiac signal within a particular classification window associated with a peak time of a captured response template;

comparing the characteristics to the one or more references comprises comparing the one or more characteristics to the captured response template; and

classifying the cardiac pacing responses comprises classifying a particular cardiac pacing response as a captured response if the one or more characteristics are consistent with the captured response template.

55. (Original) The method of claim 39, wherein:

detecting the characteristics within the particular classification windows comprises detecting one or more characteristics of a particular cardiac signal within a particular classification window associated with a peak time of an evoked response template;

comparing the characteristics to the one or more references comprises comparing the one or more characteristics to the evoked response template; and

classifying the cardiac pacing responses comprises classifying a particular cardiac pacing response as a captured response if the one or more characteristics are consistent with the evoked response template.

56. (Original) The method of claim 39, wherein:

comparing the characteristics to the one or more references comprises comparing one or more characteristics of a particular cardiac signal to a captured response template and an intrinsic response template; and

classifying the cardiac pacing responses comprises classifying a particular cardiac pacing response as a fusion/pseudofusion beat if the one or more characteristics are not consistent with the captured response template or the intrinsic beat template.

57. (Original) The method of claim 39, wherein:

comparing the characteristics to the one or more references comprises comparing one or more characteristics of a particular cardiac signal to an intrinsic beat template; and

classifying the cardiac pacing responses comprises classifying a particular cardiac pacing response as a non-captured response and an intrinsic beat if the one or more characteristics are consistent with the intrinsic beat template.

58. (Original) The method of claim 39, wherein:

detecting characteristics of cardiac signals following the pacing stimulations comprises:

canceling a pacing artifact from each sensed cardiac signal; and

detecting one or more characteristics of each sensed cardiac signal within one or more particular classification windows;

comparing the one or more characteristics to one or more references respectively associated with types of cardiac pacing responses; and

classifying a cardiac pacing response based on the comparisons and the one or more particular classification windows.

59. (Original) A capture verification method, comprising:

delivering a pacing stimulation;

defining a plurality of classification windows relative and subsequent to the pacing stimulation;

sensing a cardiac signal following the pacing stimulation;

detecting a peak of the sensed cardiac signal occurring within a particular classification window; and

determining a cardiac response based on the detected peak and the particular classification window.

60. (Original) The method of claim 59, wherein detecting the peak of the sensed cardiac signal comprises detecting a peak having an amplitude greater than reference value.

61. (Original) The method of claim 60, wherein the reference value is about 50% of a captured response template peak.

62. (Original) The method of claim 60, wherein the reference value is adaptable.

63. (Original) The method of claim 59, wherein defining the plurality of classification windows comprises:

defining a first classification window associated predominantly with a captured response;

defining a second classification window associated predominantly with a fusion/pseudofusion response; and

defining a third classification window associated predominantly with a non-captured response.

64. (Original) The method of claim 59, wherein determining the cardiac response based on the detected peak and the particular classification window comprises classifying the cardiac response as a captured response if the detected peak has an amplitude greater than a reference value and occurs within the first classification window.

65. (Original) The method of claim 59, wherein determining the cardiac response based on the detected peak and the particular classification window comprises determining a fusion/pseudofusion response if the detected peak has an amplitude greater than a reference value and occurs within the second classification window.

66. (Original) The method of claim 59, wherein determining the cardiac response based on the detected peak and the particular classification window comprises determining an intrinsic response if the detected peak has an amplitude greater than a reference value and occurs within the third classification window.

67. (Original) The method of claim 59, wherein:

detecting the peak of the sensed cardiac signal occurring within a particular classification window comprises determining a peak width of the cardiac signal; and

determining the cardiac pacing response comprises comparing the cardiac signal peak width to one or more peak width references.

68. (Original) The method of claim 59, wherein:

detecting the peak of the sensed cardiac signal comprises determining a peak width of the cardiac signal peak; and

determining the cardiac response comprises:

comparing the cardiac signal peak width to a captured response peak width reference; and

classifying the cardiac response as a captured response if the cardiac signal peak width is consistent with the captured response peak width reference.

69. (Original) The method of claim 59, wherein:

detecting the peak of the sensed cardiac signal comprises determining the peak width of the cardiac signal peak; and

determining the cardiac response comprises:

comparing the cardiac signal peak width to a non-captured response peak width reference; and

classifying the cardiac response as a non-captured response if the cardiac signal peak width is consistent with the non-captured response peak width reference.

70. (Original) The method of claim 59, wherein:

detecting the peak of the sensed cardiac signal comprises determining the peak width of the cardiac signal peak; and

determining the cardiac response comprises:

comparing the cardiac signal peak width to a noise peak width reference; and

classifying the cardiac response as noise if the cardiac signal peak width is consistent with the noise peak width reference.

71. (Original) The method of claim 59, wherein:

detecting the peak of the sensed cardiac signal comprises determining a width of the cardiac signal peak; and

determining the cardiac response comprises;

comparing the cardiac signal peak width to a near non-captured response peak width reference; and

classifying the cardiac response as a near non-captured response if the cardiac signal peak width is consistent with the near non-captured response peak width reference.

72. (Original) The method of claim 59, wherein:

detecting the peak of the sensed cardiac signal comprises determining a peak width of the cardiac signal peak; and

determining the cardiac response comprises:

comparing the cardiac signal peak width to a non-captured response and intrinsic beat peak width reference; and

classifying the cardiac response as a non-captured response and an intrinsic beat if the cardiac signal peak width is within the non-captured response and intrinsic beat peak width reference.

73. (Original) A medical device, comprising:

a pacing pulse delivery circuit configured to deliver a pacing pulse to a heart;

a sensing circuit configured to sense a cardiac signal associated with the pacing pulse; and

a control circuit, coupled to the sensing circuit and configured to define a plurality of classification windows relative to and following the pacing pulse, detect one or more characteristics of the cardiac signal sensed within one or more particular classification windows, and classify a cardiac response to the pacing pulse based on the one or more characteristics and the particular classification windows.

74. (Original) The device of claim 73, wherein the sensing circuit is configured to sense the cardiac signal through a sensing electrode combination that is less sensitive to a pacing artifact relative to a pacing electrode combination.

75. (Original) The device of claim 73, wherein the sensing circuit is configured to sense the cardiac signal through an electrode combination associated with a signal propagation delay relative to a pacing pulse delivery time.

76. (Original) The device of claim 73, wherein:

the pacing pulse delivery circuit is configured to deliver pacing stimulations using electrodes associated with a near-field vector; and

the sensing circuit is configured to sense the cardiac signals using a far-field vector.

77. (Original) The device of claim 73, wherein the control circuit is further comprised to detect noise on the cardiac signal and cancel classification of the cardiac response to pacing based on the detection of noise.

78. (Original) The device of claim 73, wherein the control circuit is configured to define a first classification window based on a timing of a cardiac signal feature associated with a

captured response and to define one or more additional classification windows relative to the first classification window.

79. (Original) The device of claim 73, wherein the control circuit is configured to compare the one or more characteristics to one or more references respectively associated with one or more types of cardiac responses.

80. (Original) The device of claim 79, wherein the one or more references are adaptable.

81. (Original) The device of claim 73, wherein the control circuit is configured to classify the cardiac response to the pacing pulse as a captured response.

82. (Original) The device of claim 73, wherein the control circuit is configured to classify the cardiac response to the pacing pulse as a non-captured response.

83. (Original) The device of claim 73, wherein the control circuit is configured to classify the cardiac response to the pacing pulse as a near non-captured response.

84. (Original) The device of claim 73, wherein the control circuit is configured to classify the cardiac response to the pacing pulse as a non-captured response and an intrinsic beat.

85. (Original) The device of claim 73, wherein the control circuit is configured to classify the cardiac response to the pacing pulse as a fusion/pseudofusion beat.

86. (Original) The device of claim 73, wherein the control circuit is configured to classify the cardiac response to the pacing pulse on a beat by beat basis.

87. (Original) The device of claim 73, wherein the control circuit is configured to use the classification of the cardiac pacing response to determine a pacing energy capture threshold.

88. (Original) The device of claim 73, wherein:

a first classification window is predominantly associated with a captured response;

a second classification window is predominantly associated with a fusion/pseudofusion response; and

a third classification window is predominantly associated with a non-captured response.

89. (Original) The device of claim 73, wherein the controller is configured to modify at least one of the first, second, and third classification windows.

90. (Original) A medical device for classifying a cardiac pacing response, comprising:

means for defining a plurality of classification windows relative to and subsequent to the pacing pulse;

means for sensing a cardiac signal following the pacing pulse;

means for detecting one or more characteristics of the cardiac signal within one or more particular classification windows of the plurality of classification windows; and

means for classifying the cardiac response to the pacing pulse based on the one or more characteristics and the one or more particular classification windows.

91. (Original) The device of claim 90, further comprising:

means for detecting noise on the cardiac signal; and

means for canceling classification of the cardiac response based on the detection of noise.

92. (Original) A medical device for classifying cardiac responses to pacing, comprising:

means for delivering a sequence of pacing stimulations to a heart;

means for defining a plurality of classification windows relative and subsequent to each pacing stimulation;

means for sensing cardiac signals following the pacing stimulations

means for detecting characteristics of the cardiac signals within particular classification windows,

means for comparing the characteristics to one or more references respectively associated with types of cardiac pacing responses; and

means for classifying cardiac pacing responses based on the comparisons and the particular classification windows.

93. (Original) The device of claim 92, further comprising means for using the classifications of the cardiac pacing responses to determine a pacing energy capture threshold.

94. (Original) A medical device for cardiac response verification, comprising:

means for delivering a pacing stimulation;

means for defining a plurality of classification windows relative and subsequent to the pacing stimulation;

means for sensing a cardiac signal following the pacing stimulation;

means for detecting a peak of the sensed cardiac signal occurring within a particular classification window; and

means for determining a cardiac response based on the detected peak and the particular classification window.